HR and VO₂ responses during basketball drills

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Introduction
Basketball coaches commonly use various forms of court-drills in order to induce specific physical and skill adaptations in players. Although these training drills are usually adopted for technical and tactical purposes they might prove useful for specific physical conditioning as well. However due to the casually intermittent nature of such drills, the potential training load is difficult to be objectively evaluated in field conditions. Despite the popularity of court-drills (particularly in the form of ball games) and their perceived importance among coaches and fitness trainers, no study has been published on the effect of this practice on heart rate (HR) and VO₂ responses on basketball players. Therefore, the first aim of this study was to examine the HR and VO₂ responses of three spontaneous basketball drills. As a secondary aim, we examined the validity of using practise HR as indirect measure of aerobic involvement during drill-games to determine if HR monitoring is a reliable tool for evaluating the physical load during court-drills.

Methods
14 basketball players were studied (age 18.9±2.3 years, height 184.7±5.9 cm, body mass 74.4±5.1 kg, VO₂peak 56.6±8.6 ml kg⁻¹ min⁻¹, Adriatica Basket, Porto Recanati, Macerata, Italy) during one bout of 5vs5, 3vs3 and 2vs2 full-court basketball games (5, 4, 3 min, respectively) performed in a random order (ROP). Court-drills HR and VO₂ responses were assessed using a portable lightweight breath-by breath gas analyser (K4b², COSMED, Rome, Italy).

HR-VO₂ relationships were assessed using a progressive incremental court-game protocol (HR-VO₂), consisting in a 5vs5, 3vs3 and 2vs2 drill progression with a stage duration of 5, 4, 3 min respectively. VO₂peak and HRmax were assessed using a sport-specific multistage shuttle run test to exhaustion (yo-yo endurance test) with subjects wearing K4b² apparatus. During court-drill protocols players freely played basketball and to avoid disruption to the play no free throws were awarded and the ball was replaced as soon as out of play. ROP, VO₂peak, and HR-VO₂ protocols were performed on separate days (at least 2 days apart) in random order.

Results
HR and VO₂ responses during random ordered court drills are shown on table 1. Individual HR-VO₂ coefficients of determinations (r²) ranged between 0.83 and 0.97 [mean 0.93±0.04, p<0.001]. Repeated measures ANOVA showed significant differences in %HRmax and %VO₂peak among the three play conditions (p<0.02 and p<0.002 respectively).

<table>
<thead>
<tr>
<th>Court-drill</th>
<th>%HRmax</th>
<th>%VO₂peak</th>
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<tbody>
<tr>
<td>5vs5</td>
<td>84.0±9.2</td>
<td>69.0±10.7</td>
</tr>
<tr>
<td>3vs3</td>
<td>88.2±8.4**</td>
<td>73.5±11.6**</td>
</tr>
<tr>
<td>2vs2</td>
<td>92.1±5.6*</td>
<td>79±10.7*</td>
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</tbody>
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Table 1: Average %HRmax and %VO₂peak values of court-drills. * = significantly different from 3vs3 and 5vs5; ** = significantly different from 2vs2 and 5vs5;

Discussion/Conclusion
The present results show that HR may be considered as a valid measure of VO₂ involvement during basketball drills. Additionally, the HR and VO₂ responses during court-drills were found to be inversely proportional to the number of players participating. The basketball drills examined in this study elicited HR and VO₂ responses known to be useful to induce aerobic fitness improvements (Bangsbo 1994, Hoff et al. 2002), with the games involving fewer players best suited for training at high intensity. These results suggest HR may be considered as a valid tool for controlling and regulate exercise intensity so that optimal training stimulus is achieved. These present findings are particularly encouraging as only spontaneous practise drills for standard exercise periods (3-5 min). We suggest that a greater control of training loads can be achieved by implementing more organised small-sided court drills via modification of playing rules, playing time, tactics, instruction and court size. Additional benefits of this type of training are that focus on technical-tactical-physical development can occur concurrently and it can also used to maintain high motivation for training.

References